

A Survey of Visualisation Tools in the Social Sciences

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Project WWW site: <http://qub.ac.uk/ss/esh/visual/>

Project E-mail discussion group: visualisation-tools@mailbase.ac.uk

1. Introduction

This report details a project jointly funded by the Joint Information Systems Committee (JISC) through the Advisory Group on Computer Graphics (AGOCCG) and the Economic and Social Research Council (ESRC) to produce a survey of computer graphics and visualisation tools in use in the Social Sciences.

Several imperatives were identified to be addressed by the survey.

- To discover current visualisation practice in different subject areas across the social sciences
- To identify specific software packages in use together with the advantages and disadvantages of using these packages
- To relay current general and subject specific technological limitations
- To attempt to establish a dialog with software vendors to discuss how technological problems might be resolved
- To engender a debate amongst social scientists on current visualisation practice.

2. Approach

In order to realise these objectives a number of steps were taken including the design of a questionnaire, the construction of a series of project web pages, the use of e-mail discussion groups, letters to software manufacturers and the development of a dedicated project discussion list.

2.1 Questionnaires

First, we wrote to the Heads of Department of all social science units in the United Kingdom enclosing multiple copies of a questionnaire to be forwarded to all interested staff. It was our belief that the full merits and limitations of particular software could only be fully established through the use of the software with real data, involving real questions and real problems. We, therefore, consulted the real experts in the use of computer graphics and visualisation software in the social sciences - **the user, in third-level institutions**. Each questionnaire (See Appendix 1 for a copy of the proforma) requested the following information for *each* software product used

- Basic information including the name of the package, version, address of the manufacturer/producer, operating system etc

- Use to which the software was put including whether used in teaching or research, specific uses and generic uses
- An assessment of the value of the software and how easy it was to use
- The advantages of the software
- Problems in the use of the software
- Possible areas of development for the software

In addition each person completing one or more questionnaires was asked to also complete one Cover Sheet including contact information and their subject area. They were also invited to make general observations on the use, or potential use, of visualisation techniques in their work

Any survey is only as good as the information upon which it is based. We therefore encouraged the widest cross-section of academics to complete our survey on the use of visualisation software. In mid-January a letter containing details of the project together with multiple copies of the questionnaire were sent to 780 Arts and Social Science departments in third-level teaching institutions throughout the United Kingdom. The list of departments was drawn from current prospectuses held by the Queen's University Main Library and supplemented through further searches over the World Wide Web. Mindful that it was quite possible, and indeed likely, that many academics might be using computer graphics but not be aware that they were using visualisation tools, in the covering letter we specifically invited responses from users of the software groups listed below.

- *Spreadsheet software* such as Excel and Quattro Pro
- *Statistical software* such as Minitab, SAS and SPSS
- *Image processing software* such as Adobe Photoshop, Imagetool, LView, and Paint Shop Pro
- *Computer graphics software* such as Corel Draw, UNIRAS and XMGR
- *Cartographic software* such as GIMMS
- *Geographical Information System software* such as ARCINFO, ARCVIEW and SPANS
- Any other computer graphics or visualisation software

2.2 World Wide Web Service

In addition a World Wide Web service (<http://www.qub.ac.uk/ss/esh/visual/>) was established to publicise the survey and encourage participation. The early service included the opportunity to complete a questionnaire online using a cgi form or download a form in WORD 2.0, ASCII or HTML format to be printed and sent through the post. An e-mail service was also devised to allow either a paper or electronic copy of the questionnaire to be sent.

This service has now grown and includes full details of the project, lists of related projects and other relevant sites including software vendors' home pages. Full project results based on the questionnaires received and replies sent by software manufacturers are now also available online. These pages will remain available on the Queen's University server for at least the next 12 months.

2.3 E-mail lists

In addition to the Institutions contacted through traditional means, extensive use was also made of existing e-mail discussion groups. Details of the project together with relevant URLs to the

project's World Wide Web pages were sent to around 40 discussion groups. Subscribers to these lists were encouraged to visit the project home page and complete a questionnaire and, further, to forward the message to other lists to which they felt the survey might be relevant, and to individual colleagues.

2.4 E-mail Discussion Group – visualisation-tools

We also established an e-mail discussion group, **visualisation-tools**, under the Mailbase system. Mailbase provides electronic discussion lists for the UK higher education community. They currently have 1,874 discussion lists, and 129,745 members worldwide.

This list provides a forum for social scientists to discuss the use of visualisation in their teaching and research. In the short-term the list was intended to augment our review of visualisation tools in the social sciences.

Traffic on the list so far has been limited although subscribers have been encouraged to visit the project home page and comment on the questionnaire responses posted. Nonetheless membership of the list has increased steadily and now stands at around 50. It is intended to continue to operate visualisation-tools and it may become an important forum for discussion in the future. Details of how to join the group are available from the project's home page.

2.5 Manufacturers contacted

Following initial survey results, software manufacturers were advised of the existence of the survey and web site, containing comments on their software. They were invited, in turn, to comment on the comments of academics using their software.

In total we contacted suppliers of 27 different software packages. The list was largely self-selecting based on the number of questionnaire replies received for each product (if only one questionnaire was received with limited comments there was little point in asking the software producer for their views) and the ease of obtaining an address for the manufacturer/distributor. In many instances software reviewers supplied contact details. The distributors or authors of the following software packages were contacted.

1. Adobe Illustrator
2. Adobe Photoshop
3. ARC/INFO
4. Claris Works
5. ER Mapper
6. ERDAS
7. Microsoft Excel
8. GLIM
9. IDRISI
10. MapInfo
11. ARCVIEW
12. Quattro Pro
13. Minitab
14. L-View
15. Microsoft PowerPoint
16. Microsoft Word

17. Microsoft Publisher
18. Corel Draw
19. Corel Xara
20. Paintshop Pro
21. SAS
22. G-Sharp
23. SPSS
24. Auto Cad
25. Toolbook
26. 3D Studio Max
27. Harvard Graphics

The response from manufacturers has been very disappointing - possibly a mark of the limited commercial importance that they place on sales to the academic, and more specifically, social science market. By early August 1998 only two manufacturers had replied to our letter, ERDAS (UK) Limited and the Claris Corporation. Their comments are included under the relevant software headings in section 3.

3. Results

The response rate to questionnaires has been limited, but not disappointingly so. We have received over 200 completed questionnaires. Of these almost 70 per cent were completed using the on-line form, many in response to messages posted to e-mail discussion groups. The number of replies to the questionnaires sent by post has been disappointing. Only 76 questionnaires were returned through the post, a response rate of less than 10 per cent bearing in mind the number sent out. It is worth pointing out that, despite personal letters, very few members of related projects, funded under this initiative, have themselves completed questionnaires! Whilst we welcome the response to the on-line questionnaire, the result is that we have a rather greater proportion of questionnaires from academics from outside the UK and from outside the social sciences - although only social scientists were asked to participate.

The limited response rate may be the result of a number of factors.

- Relevant literature suggests that a response rate to questionnaire surveys of around 20 to 25 per cent is good. The response rate here is just over 25 per cent. However, a small number of these come from academics from outside the social sciences. Further, the response rate here is based on the number of academic units contacted by letter. More were contacted through e-mail discussion groups and, of course, units contain more than one member of staff.
- Some respondents simply advised us that they did not consider themselves, or their units, to fall within the Social Sciences. We were aware of this problem but did not wish to pre-judge, on the basis of limited information, those units that were within the social sciences.
- We did not request replies from units or academics that were not using visualisation tools in their work. With hindsight we should have encouraged responses in these cases. Bearing in mind the penetration of visualisation techniques in the social sciences referred to later, to a great extent the relatively low response rate may be due to the fact that so little work involving data visualisation is taking place.

- A number of respondents commented that the questionnaire was fairly long, particularly as we asked for completion of a separate questionnaire (with the exception of the Cover Sheet) to be completed for each software product. We reduced the length of the questionnaire to a minimum compatible with receiving useful information.

3.1 Summary findings

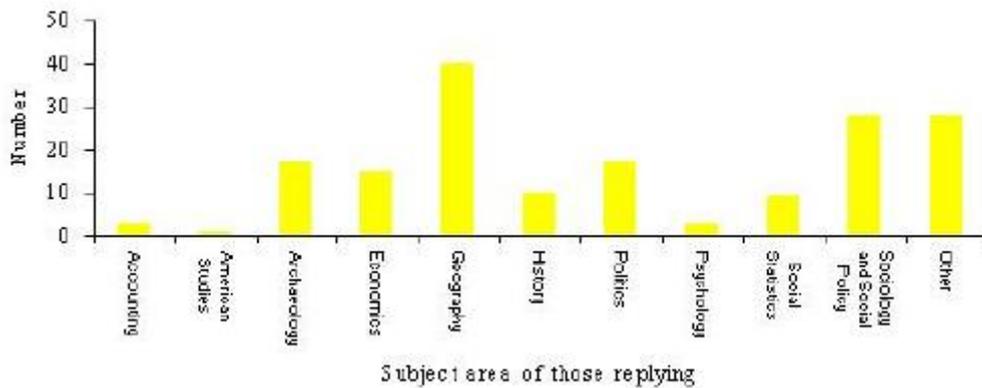
A number of general points can be made on the analysis of the questionnaires completed. The commonest visualisation tool in use in the social sciences, excluding geography, is SPSS closely followed by Microsoft Excel. In many instances, though, even these relatively limited tools are being used essentially for data storage and quantitative analysis and not for computer graphics. In geography the situation is rather different. Here GIS tools are being used - the most popular being ARCINFO and ARCVIEW. A number of other packages are in use throughout the social sciences but, based on this survey, they are being used by very few researchers. The work of few social scientists would be adversely affected if only Excel, SPSS and ESRI products were available.

For the purpose of the survey we interpreted social sciences in a broad sense. We received replies from academics in the following subject areas within the social sciences:

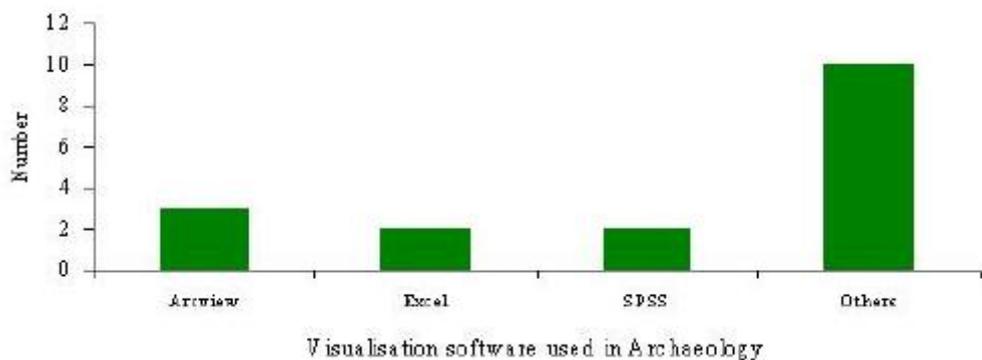
- Accounting
- American Studies
- Anthropology
- Archaeology
- Architecture
- Applied Statistics
- Business
- Ethnic Relations
- Social Policy
- Civic Design
- Classics and Ancient History
- Data Management
- Economic and Social History
- English Local History
- Economic and Social Studies
- Economics
- Environmental and Geographical Sciences
- European Studies
- Geography and Geosciences
- Historical Studies
- History
- Marketing
- Politics
- Psychology
- Information and Media
- International Relations
- Social Work
- Social Policy

- Social Sciences
- Sociology
- Transport Studies

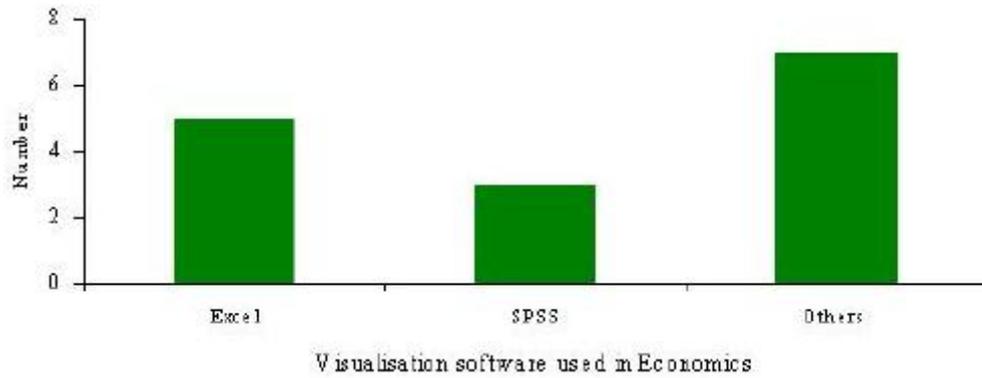
Within social science subject areas the greatest number of replies were received from members of geography departments followed by those in sociology. A more or less equal number of replies were received from those in politics, economics and archaeology. Smaller numbers were received from members of history departments and social statistics units. Few questionnaires were received from colleagues working in American Studies (probably due to the small number of units), accounting and psychology. The 'others' group includes all other responses outside these core subject areas.



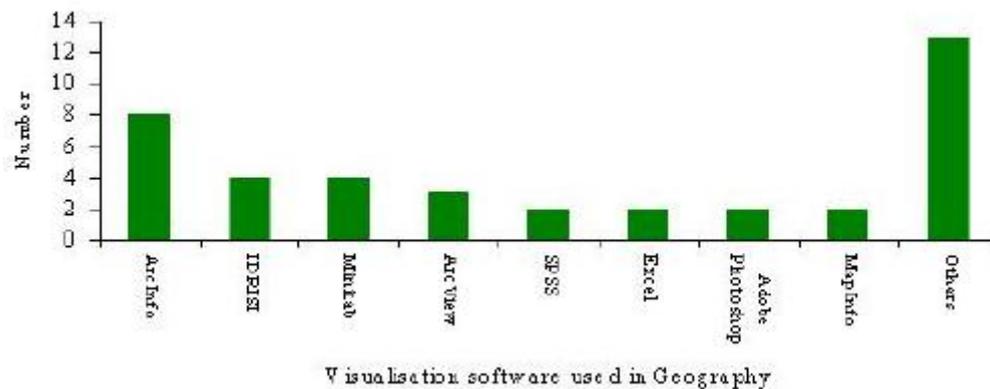
In archaeology a large number of visualisation tools were in use although none were in common use throughout archaeology departments in third-level institutions. The most common visualisation tools were ARCVIEW, Excel and SPSS.



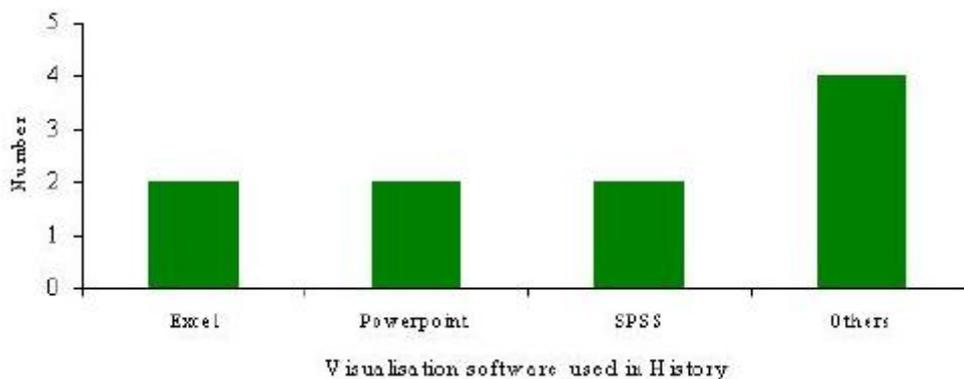
In economics Excel was found to be most frequently used followed by SPSS. As with archaeology, a number of other visualisation tools were used by individuals but, in each case, we received only one questionnaire referring to each tool. These included Microfit, Minitab and LIMDEP. All tools were used for visualisation data in a variety of graphs.



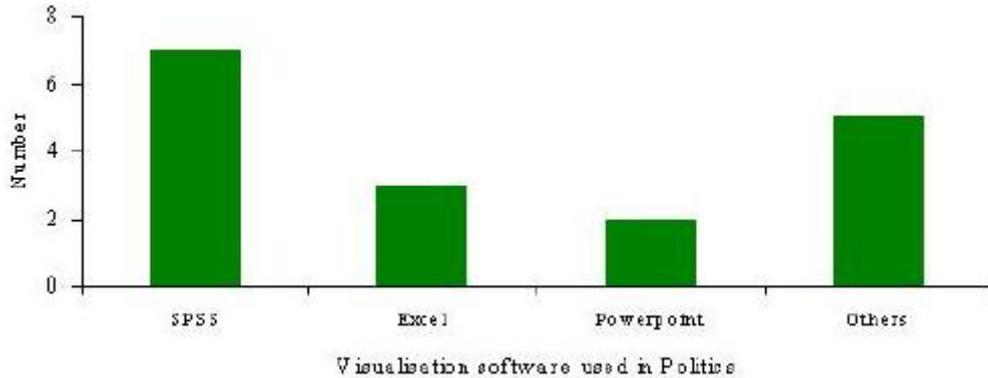
A wider range of visualisation tools were used in geography than in any other discipline. In total were received questionnaires from geographers making reference to 21 different tools. We received reports of eight software packages being used by more than one academic, again more than for any other subject area. As with other disciplines some visualisation tools were in far more common use than others were. The most popular included a range of GIS software - rarely used in other subject areas - and SPSS and Excel.



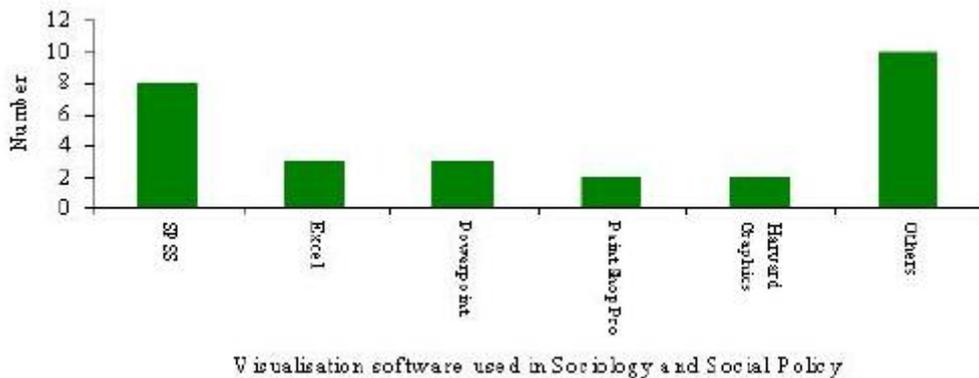
The response from history was disappointing. Only 12 questionnaires were received from members of history, economic and social history or related departments. Excel, PowerPoint and SPSS were found to be most commonly used but in each case we received only two questionnaires. Of the remainder a number of different image processing and display packages were listed. No academic made reference to the use of GIS software in his or her work.



In politics three visualisation tools were in fairly common use - SPSS, Excel and PowerPoint. All these tools were used for visualising or presenting statistical data through the use of fairly basic computer graphics. Of the other software, for which we received no more than one questionnaire each from academics working in area, all but one was used for the same purpose as the commonly used software - visualising and presenting statistical data through graphs. One academic was using MapInfo to produce choropleth maps of Russia electoral geography.

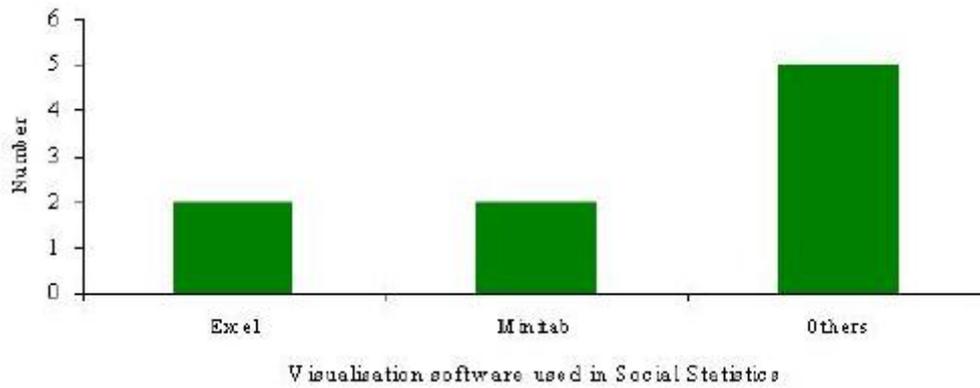


In sociology and social policy a wider range of visualisation software was found to be in relatively frequent use compared to politics. Again though, software was being exclusively to present statistical data through the use of simple graphs presented to students using software such as PowerPoint.



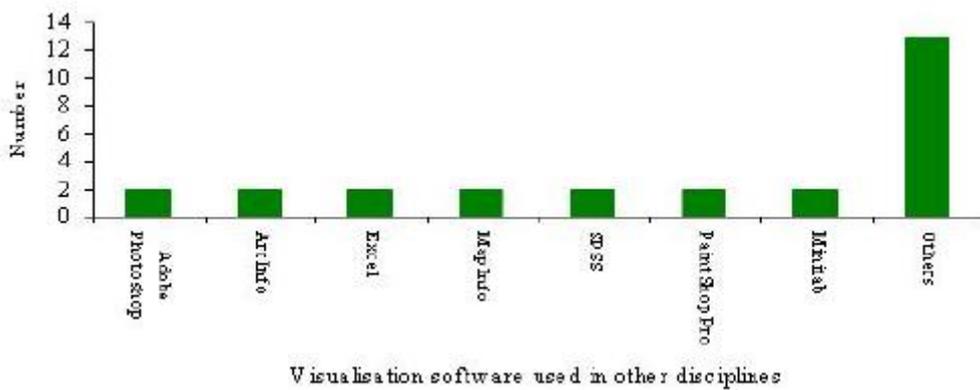
Perhaps not surprisingly, in the slightly amorphous area of social statistics, the most commonly used packages were the spreadsheet

software Excel and the statistics software Minitab. It is, perhaps, surprising however, that SPSS and SAS with arguably more advanced visualisation (and statistical) features, did not feature more strongly.



A range of visualisation tools were used in other disciplines, but none were in particularly

frequent use as the final graph in this section clearly shows.



In addition some colleagues from outside the social sciences completed questionnaires.

These included:

- Engineering
- Computing Services

- Conservation Sciences
- Government Health and Community Studies
- Computing
- Mathematics
- Nursing and Midwifery
- Physical Education
- Veterinary Clinical Studies

These contributions were a result of messages sent to various discussion groups and hits on the project web site. Except where comments are of specific relevance to social scientists they have been excluded from the survey.

3.2 Detailed results

Our examination of visualisation tools is broken down into a number of software groupings including word processing software, spreadsheets, graphics packages, statistical software, image processing software, GIS packages and WWW related software. In each section findings, based on questionnaire replies, for a range of individual packages are listed.

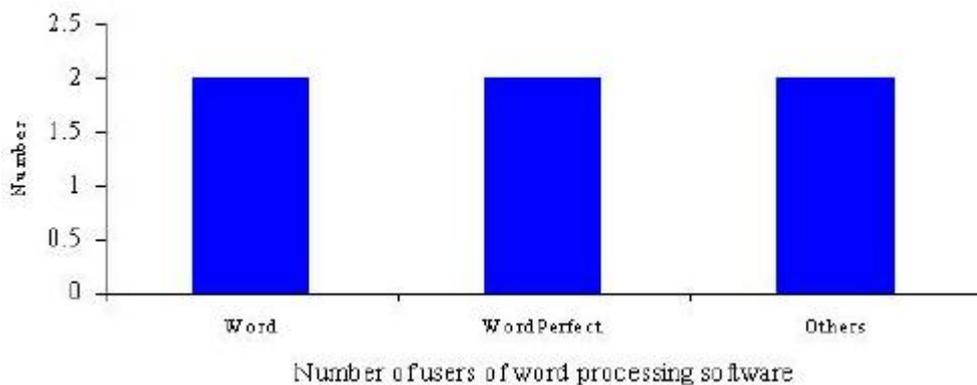
3.2.1 Word Processing software

It is perhaps a matter of some surprise that we included word processing software in our preliminary list of groups of software used as visualisation tools. We were mindful, however, that now a number of word processors have additional graphics functions, for example, the creation of flow charts, limited editing of imported image files, the creation of elaborate text and the creation of simple graphs.

From the replies we have received from our questionnaire making mention of word processing software (and there were not many) these additional functions do not seem to be widely used. Instead it would appear that more specialised and, possibly, more powerful software is being used.

Users seem to see word processors as visualisation tools in the sense that they allow text to be set out in an accessible way to allow easier dissemination of concepts in presentations.

We received two reports each on the use of Microsoft Word and WordPerfect and one report on the use of WriteNow and Microsoft Publisher. The report on WriteNow should be excluded as it came from an academic in a Biology Department.



Reports are available on the use of the following software:

Microsoft Publisher was used by one resposdee for

teaching in the creation of high quality course documentation.

Publisher was considered to be quite easy to use and very useful. It was principally used for general DTP work, image incorporation and the communication of information. For complex collections of text and documents file size was a problem, preventing easy transportation from one machine to another using floppy disks.

Microsoft Word

Microsoft Word was, based on the number of questionnaire replies, one of the more popular Word Processor in use in the social sciences (together with WordPerfect). Few if any of the software's visualisation tools seem to be being used however.

Users generally found Word to be fairly easy to use and very useful but all were using it as a basic word processing package and did not report using some of the more advanced graphic features of the software.

WordPerfect

We only received two questionnaire replies from users of this software. Both were using an old version of WordPerfect, version 5.1 for DOS. WordPerfect is now available in a number of Windows releases produced by different manufacturers as the company has changed hands. The latest release is version 8.

Neither respondents were using the visualisation tools facilities of version 5.1 which, in this early release of the software, would have been limited anyway. The software was criticised as having only a limited number of printer drivers but we suspect that this is due to its age.

WriteNow

One questionnaire, from a Biologist, was received. Version 4 of the software was being used running under MAC O/S 8.0.

WriteNow is designed to be fast and require limited disk space. It achieves this by restricting the number of *rarely used* features present in other word-processing software. WriteNow 4.0 has improved graphics import and editing capabilities. It allows cropping, scaling, and positioning of any EPS, PICT, or MacPaint file anywhere in a document without leaving the program. It works in full colour or 88 shades of grey.

The main advantages of WriteNow were listed as:

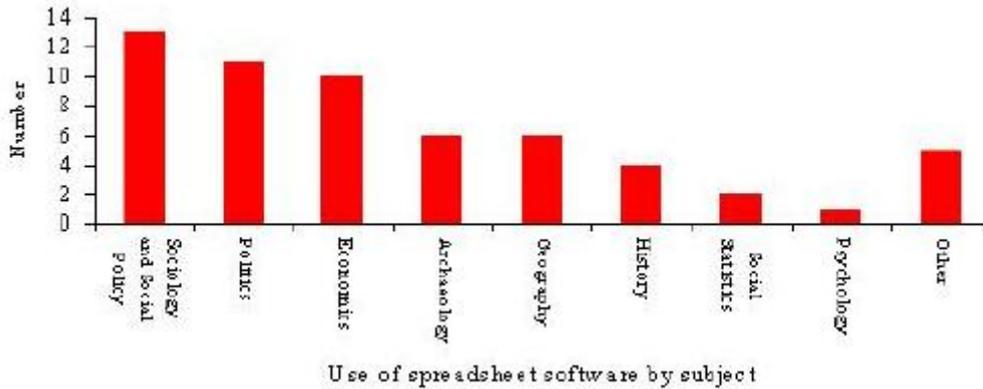
- Its speed
- The limited hard disk space required by the program
- A good interface with EndNote

However, visualisation tools associated with the software were not being used.

3.2.2 Spreadsheets

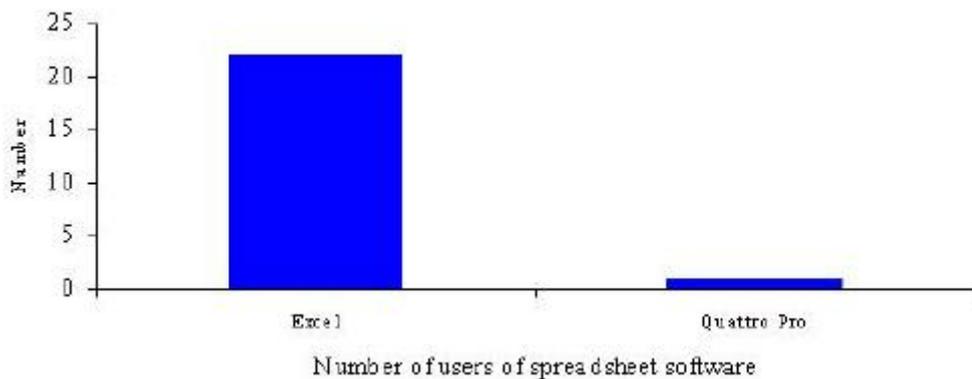
Throughout the social sciences, excluding geography, spreadsheet software was frequently cited as one of the main visualisation tools in use. Of these spreadsheet packages Microsoft Excel was by far the most popular. Only one questionnaire referred to the alternative package Quattro Pro. One respondent wrote 'We used to use Harvard Graphics but they are now so non-standard that we cannot expect them to be installed.' Another described Excel and 'the industry standard'.

Spreadsheet software was used across a wide range of social science disciplines. We received most reports on the use of spreadsheets from academics in sociology and social policy, politics and economics but in almost all areas of the social sciences spreadsheets were being used. In fact, as we have suggested, spreadsheet software, and in view of the heavy bias towards the use of Excel, here we can really say Excel, is the visualisation tool of choice and practice in most social science subject areas.



Spreadsheet software, of course, does not have particularly complex visualisation tools. Later versions of Excel allow the creation of 3D graphs and,

through a link with MapInfo, some mapping functionality. Based on the findings here, however, the limited visualisation functions of spreadsheet software were not fully utilised. Most users in the social sciences use spreadsheet software to store and manipulate numeric data. Some analyse quantitatively these data within the spreadsheet and some produce statistical graphs such as pie and bar charts. There were some complaints concerning the range and quality of these graphs but mostly these were from users who were using early (or very early) software releases.



To reiterate, responses were received, and further details are available, for Excel and Quattro Pro.

Microsoft Excel

By far the most common piece of spreadsheet software in use in the social sciences - often bundled with other Microsoft Office products.

A number of different versions of Excel were in use including versions 4, 5, 6, 7, 95, 97. Excel was being used on Macs and PCs running Windows 3.x, 95 and NT.

Excel was generally being used in both teaching and research. Its main uses were for

- Data manipulation
- Graphing - particularly using the Chart Wizard on later versions
- Use of import and export options
- Simple mathematics and statistics
- The creation of derived data
- Tables
- Macros
- As a link to WORD

Of the visualisation features users made particular reference to the use of bar charts, line charts and pie charts.

In teaching Excel was considered to be useful as a tool for data presentation. It was used as the software in a first year 'Introduction to Statistics for Social Scientists' module with supporting workbooks and data supplied by the ESRC Data Archive. Feedback suggests that it was well received by students.

Excel was considered to be fairly easy to use. One respondent commented that the software was much easier to use than Lotus.

Specific advantages included the quality of graphical output, the speed with which graphics could be produced, the ease of graphing from raw data, the power of the package, its integration with other software, the fact that it is the industry standard, the linkage between spreadsheets and graphs, the high level of support available, as a means of data transfer because it is in such widespread use.

Specific problems with the software included insufficient variation in fill patterns for charts. Graphs were difficult to fine-tune. One respondent commented that graphing using Excel 5.0 was far from user-friendly and students in particular had problems with this aspect of that version of Excel. Another said that the graphs were poor. The software did not handle missing data well. With large datasets it was slow. A user suggested that in version 5 the manuals and help facilities could be improved.

In terms of software development, it was suggested that some of the most powerful features of Excel were available as add-ons and their presence was not readily apparent. At the other end of the scale it was suggested that Excel should be designed in a series of mini applications which the user could select based on their specific requirements. It was suggested that Excel should be linked to an inbuilt OCR system so read data direct into the spreadsheet. Better functionality in determining graph layout was also proposed together with an enhanced range of graph types.

Interestingly some of the most critical comments concerning Excel came from a respondent outside the social sciences - in a biology department. He describes Excel as cumbersome. The software occupies too much hard disk space and does not store data efficiently (Others make similar comments). He argues that it suffers from being an all in one package including a spreadsheet, database and graphing program. As a consequence none of the sub-applications are optimised - the user gets the worst of all possible worlds. Perhaps most damning of all, it is argued that Excel has no features better than competitors.

Quattro Pro

Compared to the spreadsheet software Microsoft Excel very few respondents reported using Quattro Pro in their work.

In the social sciences we found users using versions 6, 7 and 8 of the software. The software in all cases was found to be used for both teaching and research. The chart features of Quattro Pro were generally used for lecture presentations and in the preparation of material for publication. The package was also used for statistical analysis of datasets.

Amongst the positive views of the software was that it was easy to use, the on-line help facilities were very good and that the range of statistical tests were extensive. One respondee wrote 'Very easy to use. Statistical techniques are very comprehensive. You can compute almost anything very easily.'

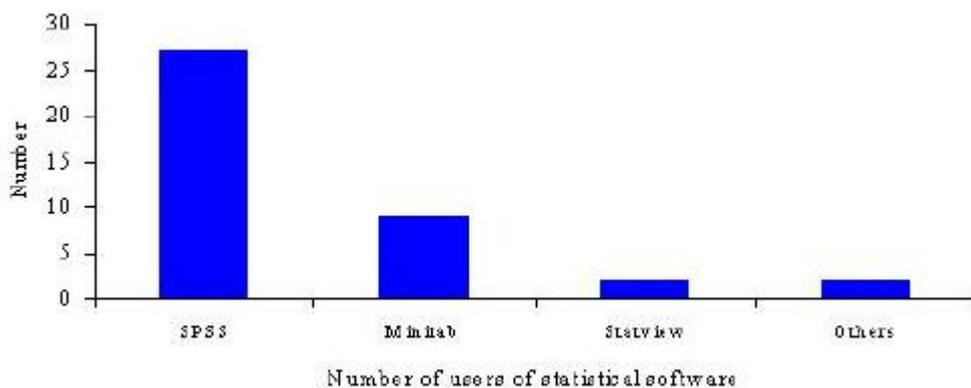
Corel Quattro Pro version 7 was specifically criticised for providing poor printer support, surprisingly when used with Hewlett Packard printers. In particular visualisations appearing on a computer monitor were not accurately rendered to hardcopy.

Interestingly, against the backdrop of the popularity of Excel, one respondee wrote 'I shall probably shift to Excel in 1998 because of LSE support focussing on MS Office.'

3.2.3 Statistical software

We received 48 questionnaires related to the use of the data visualisation functions of statistical software in the social sciences. From these results it is clear, however, that statistical packages are primarily being used to store, manipulate and quantitatively analyse data. The graphics functions of these software packages were not widely used.

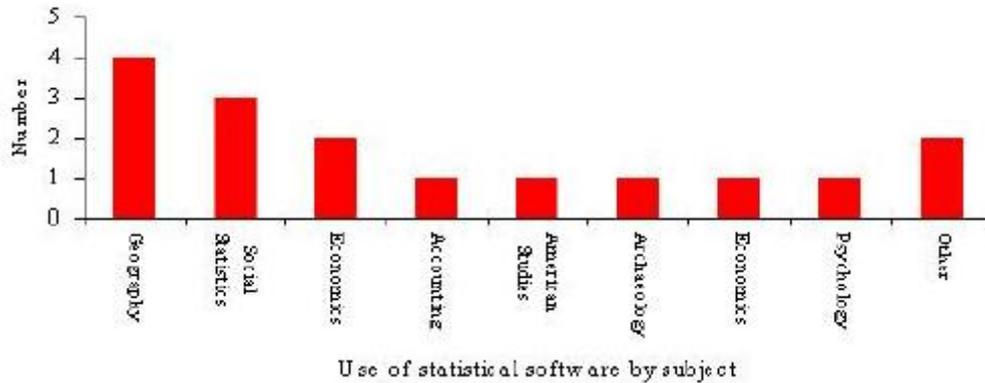
As the graph shows, SPSS was by far the most popular statistics package in use in the social sciences. In total around 60 per cent of users of this group of software were using it. Minitab was the next most popular statistical package with around 15 per cent usage. SAS was next most popular followed by Statview. For other statistical software only one questionnaire reply was received in each case.



Statistical software was widely used throughout the social sciences.

Unlike visualisation tools such as GIS software it was not predominantly

used in any one subject area. We received most reports on the use of statistical software from geography, social statistics and economics. We received one questionnaire each from a number of other subject areas. Interestingly, and no doubt a product of the limited penetration of this survey, we received no reports at all on the use of statistical software in history.



In detail responses were received for the 13 different packages.

ExperStat
We received one questionnaire referring to

ExperStat used on a Macintosh OS 7 or 8.

ExperStat was used in teaching as a straightforward introduction to ANOVA, but the software also has the capability to carry out other statistical tests. The software's particular strengths were listed as

- Simple data entry
- Good documentation
- Clear tables and graphs
- and, overall ExperStat's simplicity

The main disadvantage of the software was that its capabilities in terms of the sophistication of statistical tests were limited. It was also pointed out that a number of other statistical packages with similar functionality are available.

LIMDEP

We received just one brief report on the use of LIMDEP, an econometric package in this instance used in research. The software was described as being fairly easy to use and very useful. Its main value was in the increased productivity it afforded.

Matlab

One respondee discussed the use of MATLAB in teaching. The software was described as being neither particularly easy nor difficult to use. It was viewed in high regard however.

Specifically the software was used for

- Matrix manipulation
- Use of the language script to customise statistical tests
- To visualise data
- Analyse data with customised procedures
- To produce graphics

Particular advantages were listed as:

- Ease of customisation
- Informative error messages
- The ability to handle large matrices

The main disadvantage was the time taken to learn the application. The UNIX version is command-line driven.

In terms of software development an interactive graphic editor would be of value.

Microfit

We received one report on the use of Microfit for econometric estimation in teaching and research. Microfit was described as both being very easy to use and very useful.

The software's main advantage was described as its menu driven interface. This was also listed as its main disadvantage!

The most useful software development would be the ability to write macros to be inserted into the current user interface need to keep up with statistical developments.

Minitab

Minitab was the second most popular statistics package in use in the social sciences. It was used both in teaching and research although some users regarded it as a more limited research tool. No one found Minitab difficult to use and it was generally regarded as being either 'very easy' or 'easy' to use.

Minitab was used for:

- Statistical analysis including descriptive statistics, tests of association, tests of difference, control charts, tables etc
- Result plotting such as histograms, boxplots, regression plots, scattergrams, bar charts etc
- Introductory Data Analysis year 1 Social Science

The main advantages of Minitab were described as:

- The flexibility of command line syntax allowing instructions to be written in English.
- The menu-driven interface on later versions
- User Friendly
- Good help facilities
- Does not distract from statistics by over fussy computing
- Has all main techniques available
- Very basic quick draw graphics for quick look in analysis
- Good graphics and output - although other users suggested that the graphics were poor!
- Less steep initial learning curve than many statistics packages
- Well adapted for teaching use, but good enough in recent versions for many research purposes
- Powerful macro language for writing purpose built special analyses

Minitab's disadvantages were listed as:

- Inbuilt routines are insufficient to allow this to be used as an advanced tool for applied research
- Poor graphics - although later releases have steadily improved Minitab's graphics facilities. One user wrote 'Has come a long way in improving its graphics, which were a major

weakness.' However, another wrote 'lousy graphical capabilities'. I great deal depends on the version of Minitab being used.

- Cannot easily read data from other packages
- Spreadsheet is not as easily manipulated as in other packages such as Excel
- Tabular output is not as good as SPSS - needs the concept of value labels for variables
- Limited coverage of econometric methods
- No built in optimisation for Holt Winters' forecasting
- Poor 'help' in some instances
- 'The students always forget how to enable the command language - then find the multiple windows confusing.'

The software would be improved by

- Development of a library of off-the-peg subroutines
- Better and more flexible spreadsheet functions
- Better logic and transfer of control functions for batch programs
- Dynamically linking graphics and data
- More econometric facilities built in
- Better help pages

SAS

Surprisingly we received only one questionnaire describing the use of SAS. In this instance SAS was being used in both teaching and research.

Whilst SAS was regarded as being very useful, it was also described as being very difficult to use.

Specifically SAS was described as being flexible. The graphics module is part of very powerful statistical and data transformation package. Its main disadvantage was its difficulty of use - SAS is not a package for the novice user.

The most significant software development would be an easier to use front-end for charts etc. along the lines of what is available in competitor packages such as SPSS.

Schema

We received one report on the use of Schema in research. The user felt that the software was both easy to use and very useful. Schema was used for data analysis, data manipulation and data representation.

The software was particularly valuable because of its speed and ease of use. No drawbacks were identified.

SECOS

SECOS, produced by Statistics for Education, is available for both DOS and Windows platforms. It offers a front-end to statistical datasets allowing data manipulation, analysis, graphing and mapping. The software is particularly useful in teaching quantitative techniques to students.

We received one report on the use of SECOS for teaching levels I and II and Masters students in Sociology and History.

SECOS was considered to be very valuable and fairly easy to use - 'Sociologists can use it anyone can!!!'

SECOS was used for:

- Mapping
- Graphics
- Statistical Testing
- Extracting Data
- Analysis of specific pre-prepared datasets such census statistics and social and European trends

Particular advantages were listed as:

- Easier than going to the library to look for statistics
- The mapping interests enumerate students
- The statistical tools are easy to use

The only disadvantage cited was that SECOS discouraged students from looking for other sources.

SigmaStat

This statistical package was not widely used in the social sciences in the United Kingdom. In fact only one questionnaire made reference to the software from a respondent in the United States. SigmaStat requires a 486 IBM PC running Windows95.

The respondent used the software for both teaching and research. Specifically the software was used for descriptive statistics, chi-squared analysis, regression analysis and t and z tests. The software was considered to be easy to use and within the constraints of the software very useful - 'This is a good starter package. Not very powerful, and not all that flexible, but simple and instructive.'

It was considered to be particularly valuable as a teaching tool. The software includes an *analysis wizard*, which helps to determine the best analysis to run. Following statistical tests it gives an indication of significance levels where appropriate.

SigmaStat is limited in that data inputting is not as straightforward as with some other packages. It will not allow alpha data to be coded and the range of statistics is limited compared to some other software.

The software could be improved by upgrading the analysis wizard and the interface more generally.

SPLUS

Another statistics/graphics package used infrequently in the social sciences. The software was used in research and for the creation of diagrams for papers. It was considered to be very useful but not particularly easy to use.

Particular uses/advantages of SPlus included the good 3D graphics and the non-parametric output. However, some programming using the SPlus language is usually required. The language has become easier to use over time. Also it is often hard to get things exactly right re: margin sizes etc.

SPSS

SPSS was by far the most frequently used statistical package in the social sciences. In total 27 questionnaires were received describing its use. SPSS was used in both teaching and research. Some respondents used SPSS solely in teaching, others solely in research and others in both activities. Generally SPSS was found to be 'easy' or 'very easy' to use. A small number of respondents found the software more difficult - particularly when students were being taught to use it. Virtually everyone found SPSS to be a 'very useful' tool.

The software was used in a range of applications including specifically:

- Charting Russian voting patterns and socio-economic characteristics
- A class developed with assistance from the US Department of Education called New York city's Lower East Side, 1880-1920.
- Teaching postgraduate masters students and also in applied research to study survey data.
- Teaching at undergraduate and postgraduate levels. Mainly in Quantitative Data Analysis and statistics based modules. Also for individual dissertations.
- Analysis of data from the Bangor Longitudinal Study of Ageing and Older People in Europe's Rural Areas.
- Analysis of questionnaire data in teaching and research.

Generic applications for SPSS were described as:

- Data Entry
- Recoding and transforming data
- Data management
- Preparing large and complex data
- Explore data
- Large-scale analysis
- Visualise numerical data
- Statistics
- Graphing
- Batch file Running

Its main strengths were listed as:

- Ease of use particularly with the Windows releases. Far easier to work with than DOS-based statistical applications.
- Very user friendly
- Covers most routine analyses
- Presentation quality tables and graphics. One respondent wrote 'I no longer have any need for Harvard Graphics, for instance, which I used to use.' Another wrote 'It took me a few weeks to figure out the nuances of making the charts, but once I read through the instructions, I figured out how to customise the charts and now find the software very efficient and useful.'

- University site license enables all to use of SPSS with no cost at the Departmental level rather than individual researcher/lecturers having to make a case for purchasing unusual software.

SPSS's weakness were described as:

- Some criticism of the graphics facilities including problems in positioning graphics precisely on the pages, difficulties in editing graphs, limited graphical capabilities in early releases.
- Need to have some of the newer graphs - dot plots, mosaic plots, comparative bar charts with central base line
- The graphic editor is not very versatile.
- Automatic scaling: makes it difficult to present different charts using the same scale for comparisons.
- Need for fast processor for work with charts
- Too easy? Inexperienced users may be unknowingly applying the wrong or inadequate methods
- Can be off-putting to the beginner - the learning curve is still somewhat steep for some undergraduates.
- Lacks many regression analysis techniques.
- Difficult to edit output.
- Problems with importing and exporting data in a variety of formats.
- Poor error messages on occasion - not always easy to associate with correction needed to the code.
- Limited functionality for complex analysis
- In batch mode one error halts the whole file running.
- Can be slow at times if not using the latest hardware
- Difficulties running SPSS across the networks in relation to the large temporary datafiles it creates.
- You need knowledge of statistical terminology to operate the software and some of the language is specific to SPSS.

Possible areas of software development included:

- More flexible editing of graphs including the ability to click and drag graph elements.
- Enhanced graphical capability would be an advantage to many
- More graph types and specifically better Stem and leaf charts
- Improved export facilities. One respondent wrote 'Particularly I would like to be able to export .spo graphics, maintaining the appearance that they have in SPSS'
- Made simpler still for undergraduates
- Manuals could be much more user friendly
- Improvements to syntax window
- Easier repeat procedures for analyses are required. Maybe some macro or learn feature, so that new data can easily be processed quickly using the same sequence of analysis commands applied to previous data sets.

Amongst the general comment received respondents wrote:

'I prefer to use other packages for my research. I think my students find it quite difficult to use.'

'I provide the opportunity for students to obtain their own data rather than use that provided by the manufacturer. This makes learning personal and meaningful.'

'After an initial introduction to the system it becomes quite routine and reasonably easy to use.'

'It is sometimes difficult to get undergraduates into the package quickly although the later versions are a big improvement on earlier versions.'

'Once students understand the way that SPSS operates then they find it easy to use the software. The only problem that I can see is that it can be too easy for students to undertake statistical tests without understanding what and why they are doing it!'

'SPSS is far superior to SAS for the PC, although it has weaknesses in graphic output and some other basic operations needed in statistical analysis.'

'Still believe SPSS hasn't moved to true windows version. The 7.1 is a move in the right direction, I welcome some of the new features, interaction diagrams, some post hoc testing. The graphics environment is still slow and basic.'

Statview

Another statistics package rarely used based on our survey results. Statview was used primarily for generating statistical output. The software was considered to be 'almost idiot-proof' with easy output - the reason given for not using SPSS. The graphics was described as useful but the range of analyses were limited. The software would be improved by increasing this range.

XLISP-STAT

Good reliable software but a steep learning curve. Full programmability in a real programming language makes the system flexible, but a little harder to use than most.

Specifically the software was used for:

- Interactive, linked graphs
- Simulation abilities
- Basic statistics (descriptive)
- Advanced statistics (i.e. SLIM)
- General programming (i.e. coding)

Particular strengths of XLISP-STAT were listed as:

- Freeware
- Programmability
- Flexibility
- Interactive graphs for exploratory data analysis
- Built in statistics and functions

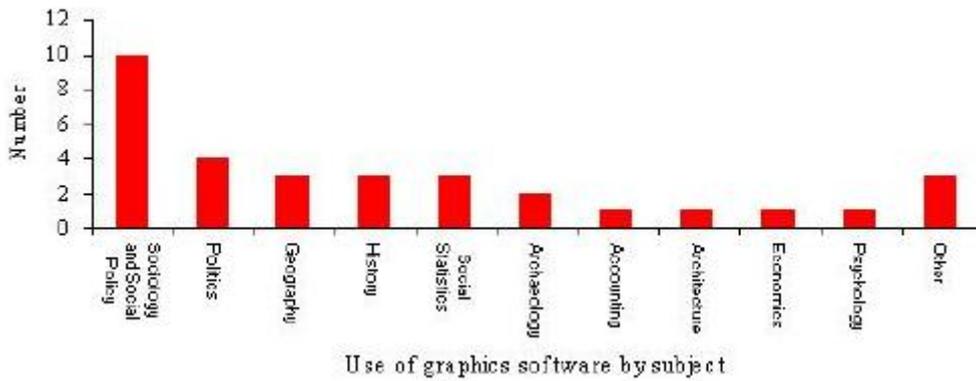
The one problem listed with the software was the difficulty of reading in some data formats.

The software could be improved through the introduction of some fairly specialised statistical techniques, such as spline smoothing - which may be used in conjunction with visualisation.

3.2.4 Graphics software

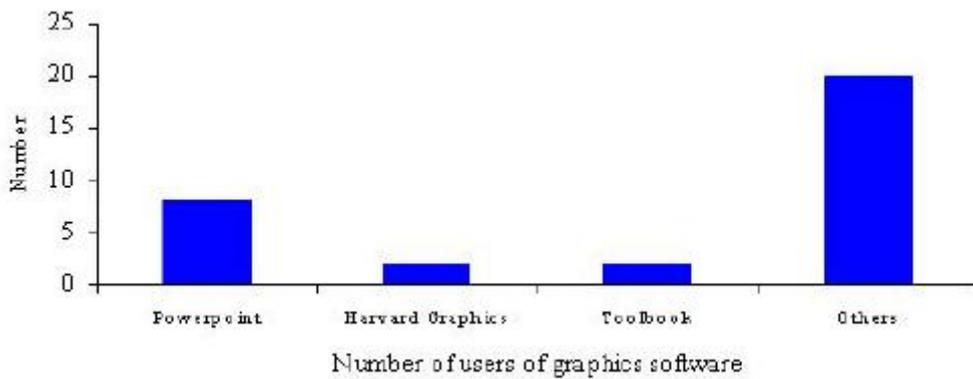
It is not easy to differentiate between graphics software and image processing software in some instances. Therefore, the reader should also consult our section discussing the use of image processing software.

What then can be say by way of summary on the use of graphics software in the social sciences? Here the graphs below detailing the number of questionnaires received broken down into subject area and into software product are helpful. It is clear, first, that graphics software is in widespread use throughout the social sciences. We have reports on its use in every subject area. Most reports come from sociology and social policy with politics following some way behind.



PowerPoint was the most frequently used software with eight questionnaires received. Harvard Graphics and Toolbook

followed PowerPoint. Of the other 15 software products in this section we received just one report on their use each. As with spreadsheet software, the use of graphics software is widespread but, unlike spreadsheet software (where Excel dominates), a very wide variety of different tools are being used.



Responses were received for the following software products. More detailed comments are available under each sub-

heading.

3Dstudio Max

A specialised visualisation package used in CAD and specifically from questionnaire responses in Architecture. Version R2 produced by Autodesk Inc, running under Windows95 was reported on.

The software is used by architects, landscape architects, furniture designers, sculptures etc. Its main use is to give an impression in three dimensions of colour, light, texture and form. The

software was described as being quite easy to use and very useful. However, it was also described as being expensive.

In terms of product development sunpath placement would be valuable in order to give an impression of light at a particular time of day for a particular latitude. These comments have been passed to Autodesk.

Artworks

We received one report on Artworks from an Economic Geographer running the software on an IBM PC clone with 4MB of RAM.

The software was being used for research involving vector drawings and was considered to be very easy to use. It was also considered to be very useful on account of its speed and ability to interface with a range of other software.

AutoCad

We received one brief questionnaire describing the use of AutoCAD, version 13 running under Windows NT in Archaeology.

The software was being used in the generation of 2D and 3D Drawings and in digitising. Used in both teaching and research, AutoCAD was described as being very useful but quite difficult to learn.

Claris Works

An integrated package with similar functions to Microsoft Works. It includes, with the spreadsheet module graph-generation functions and has a drawing and paint package.

We received one report of Claris Works use in a Sociology Department. It was found to be easy to use and very useful.

Its particular advantages as a visualisation tool were listed as:

- Easy to use and learn
- Not memory hungry
- Stable software

As might be expected for an integrated package, the main disadvantage was that the software would not draw complex graphs. Equally, this was viewed as the most important area of future software development.

Claris Corporation has advised by letter that they are now focusing exclusively on information-management solutions and particularly FileMaker Pro database software. As a result the group will no longer support Claris Works which will, in future, be developed and supported by Apple Computer Incorporated.

Corel Draw

Two questionnaires referred to Corel Draw, one to its use in teaching, the other in research. The software was used for creating relatively simple graphs for use in lectures, in work books and for WWW pages. The software was also used for image importing, retouching and masking.

Particular advantages were cited as:

- Colourful
- Good text
- Nice graphs

Particular disadvantages were cited as:

- Limited use for very specific purpose
- Fiddly to use at first
- Quite slow
- Heavy on memory

No software developments were suggested.

D-prime Beta

Thanks to [Peter Naish](#) who provided details of D-Prime Beta. Peter wrote the software (running under MacOS 7/8) to analyse signal detection parameters and display results graphically. Peter is a cognitive psychologist.

D-Prime Beta permits demonstration of the principles of Signal Detection Theory and allows the standard parameters of SDT to be determined in two simple situations. Measurements are in either the visual or auditory modality; in the visual example stimuli are lines and S is required to detect short lines from a sequence of longer distractors. The auditory analogue requires detection of short 'beeps' from longer sounds. The difference between long and short may be entered in advance, using the 'Parameters' menu. This menu allows numbers of stimuli and proportion of signals to be set also. If preferred, a rough-and-ready method is available (under the 'Test' menu) to determine the just-noticeable-difference for either sounds or lines. Once a JND has been found it is automatically used in the SD tests. The default value is 10 units, which is 10% of the long line and 33% of the long tone. When the SD trial has been run, a summary of the data is presented, followed by the values of D' and ' and a sketch of the signal and noise curves and criterion point. If data amenable to SD analysis are available from elsewhere they may be analysed by using 'Calculate', from the 'Test' menu. Where zero false alarm or miss rates are entered, the convention of adding 0.5 to the score is adopted.

The program has been made available at this stage, following requests for an early release. Suggestions for improvements and additional facilities would be welcomed.

Freelance

We received one report on Freelance from a sociologist. They were using version 2 on a 486 PC running Windows 3.1.

The software was being used for presentations such as flow charts in teaching and was considered to be fairly easy to use.

GLIM

Another graphics package that is rarely used by social scientists. One reply was received from the Centre for Applied Statistics at Lancaster University. The reply made reference to GLIM 4 running on a Windows machine and was used for the production of postscript and on-screen line graphs in both teaching and research.

The software was considered to be very useful. Reference was made to the value of the command language providing simpler functionality than a complex series of menu options. The postscript files also fed well into latex for publication.

The software could be further developed by the addition of a wider range of device drivers and the production of a full Windows version of the software.

Gsharp

Gsharp has replaced Unimap and Unigraph although these products are still available. It has many more features and a much more up to date interface. It is primarily used for the creation of 2D, 3D and 4D graphs.

This software is not extensively used in the social sciences. A member of our project team completed a questionnaire, but this was the only reply we received. Many users were used to the Uniras interface and find Gsharp more difficult to use. This is, perhaps, reflected in the apparent unpopularity of the software in the social sciences.

The software has facilities which are simply not available in other packages. It has particular advantages in terms of the range of types of graph it can produce, the number of printer drivers it supports and the flexibility of the scripting language. Whilst not particularly difficult to use users must spend time acquainting themselves with the software to a greater degree than with some other packages. The VMS version of the software has a number of drawbacks making Unimap and Unigraph the preferred choice on this platform.

Harvard Graphics

One questionnaire was received describing the use of Harvard Graphics version 2.0 for DOS. The respondent also had access to versions 2.0 and 3.0 for Windows.

The software was used in both teaching and research for the immediate production of charts such as pies, bars, area and line and was considered to be very useful and quite easy to use.

The main advantages of Harvard Graphics were listed as

- Speed
- Ease of use
- Direct link to SPSS
- Professional output good enough for publication
- Rapid conversion to other presentations
- A DOS screen with less light and hence flicker.

The main disadvantages were listed as

- The lack of import and export facilities - for which the Windows version of Harvard Graphics is required
- Labels occasionally overlapping.

The respondee also commented that DOS was a dying operating system.

Macintosh Common Lisp

We received one report of version 4.2 of this software being used running under MacOS.

The software was used in research for computer simulation. The main advantages of Lisp were listed as

- Speed
- Brilliant programming environment.

Disadvantages included:

- Few high level graphics tools
- Need to do low level programming to get good visualisation

The software would be improved through enhanced graphics.

Microsoft Drawings

One respondee in Economics made reference to Drawings - a fairly easy and useful drawing package for drawing graphs within WORD documents used in the preparation of teaching materials.

The software's main advantages were its straightforward intuitive mouse-driven actions and the ease with which images could be embedded within WORD documents. Its main disadvantage was the difficulty of using a mouse for drawing lines as opposed to a pen.

Microsoft PowerPoint

PowerPoint was the most popular graphics/presentations package in use in the social sciences. Eight questionnaires made mention of it. A number of different versions were in use both on PCs and Macs from 4.0 to the latest - 97 - release. PowerPoint was generally found to be very easy to use - no one found it difficult even though not all had access to manuals. All who used it found it to be useful or very useful.

In all cases PowerPoint was used in teaching - not in research. In particular it was used for:

- Dynamic/interactive lecturing support
- DTP Work
- Use of clip art

Particular advantages were listed as:

- Ease of preparation of material
- Ease of amendment in response to class questions
- Clarity of presentation
- Speed and lack of clutter in lecture area
- Quality presentation in the context of a cultural/society that expects professional visual material

- A guiding framework for lectures.

Disadvantages cited included:

- Not a software problem but a hardware one - many lecturer theatres do not have the necessary equipment such as PC and projection tablet to stage a PowerPoint presentation
- Can be overused and distract from content of the lecture
- High memory demands
- Need for a reasonable sophisticated computer
- File size limits transferability of presentations

Suggested software developments included:

- Better fill patterns
- More non-US clip art
- Ability to shade in more than one area at once

Surfacer

A specialised visualisation package used by Archaeologists to build surface models of artefacts, verify model accuracy, provide an electronic database of artefacts including their physical properties, and to allow interactive visualisation.

Surfacer V, developed by Imageware, Ann Arbor, runs under SGI IRIX. Its particular advantages were described as its user-friendly nature, ability to cope with data in a range of formats, ability to handle precisely complex geometry and its interactive verification and editing facilities.

The main disadvantage with Surfacer was its cost.

In terms of software development 'For those of us interested in solid modelling, we would like to see better data exchange facilities with IDEAS Master Series.' These comments have been passed to the manufacturer.

Tolis123

We received one completed questionnaire discussing the use of Tolis123 version 5 running under Windows 3.1. The software was being used to create graphs in research. No further details were provided.

Toolbook

We received two reports of Toolbook being used, in both instances in teaching. The reports describe version 3 and version 4 of the software. Toolbook was used to create digitally based support materials for lectures and materials for students to refer to after lectures. It enables the creation of interactive diagrams and models.

The main advantages of the software were listed as:

- Simple commands and built in features allow the construction of useful courseware packages
- Very sophisticated simulations can be created by programming
- Based upon "books, pages and objects" together with object oriented programming facility gives great flexibility
- It has the capabilities of Java and DHTML but without really complicated scripting

- Objects can be moved with a quite simple script compiled with a tracking editor
- It is more interactive than web pages with a low level of scripting capability

One respondee wrote 'It has enabled us to create a whole range of simulations, Bihari Farmer, Africa in Crisis, Virtual Malta, Skills Shop and a number of DBSMs for years 1 and 2 of the Environmental Science degree.'

Disadvantages were described as:

- Time-consuming to create good results
- Programming skills are required to get the best from the software
- There can be a problem of delivery if you build something very sophisticated, e.g.: animated 3D graphics, will not run on many machines
- Limited multimedia (version 3)
- Cost of upgrade
- Have later Asymetrix products been overtaken by the web?

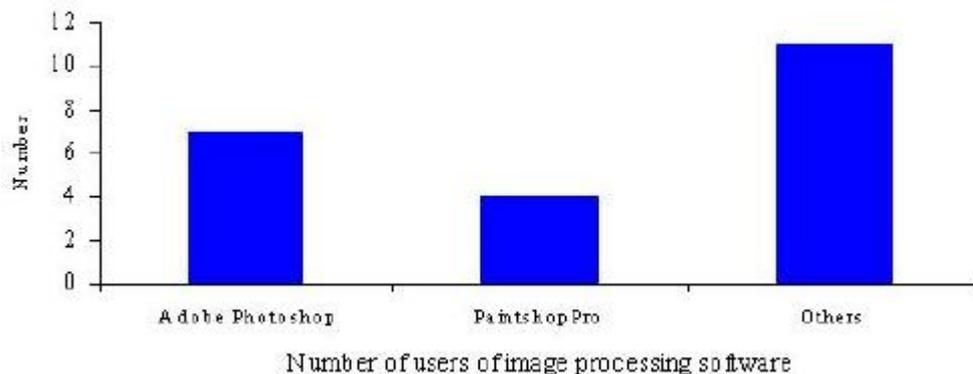
xmgr

We received no reports of XMGR being used by social scientists. A member of our group - based in Computing Services - completed a questionnaire.

The software is used to generate graphs. Its main advantage is that it is a free package for Unix operating systems. However, as with all free packages there is no guaranteed support or upgrades. In terms of development new graph types and a PC version could be introduced.

3.2.5 Image processing packages

Readers should consult the comments under Graphics Software. Many of the same points can be made for Image Processing Software. The software was used more or less throughout the social sciences. Most questionnaire replies came from geography and sociology and social policy but no one subject area dominates. Equally, a number of different packages are in use. Adobe Photoshop and Paintshop Pro were most frequently used but we also received reports on the use of nine other packages.



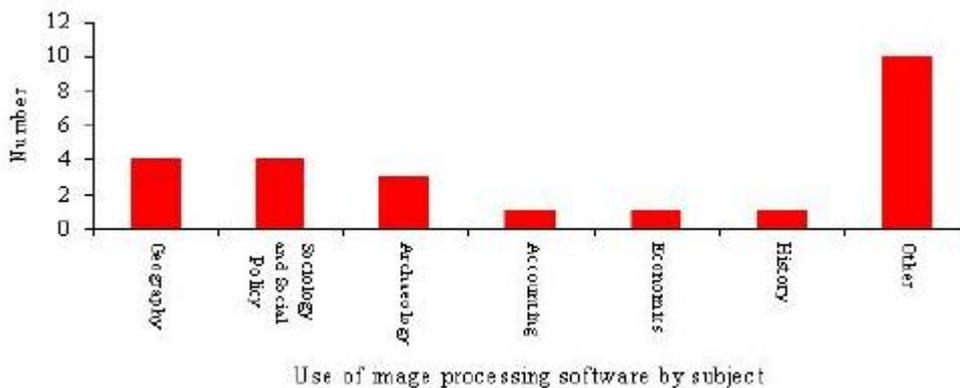
Responses were received for the following 11 software products.

Adobe Illustrator

Survey results suggest that Adobe Illustrator has no users in the social sciences! We did, however, receive one review from a software-training agency. These views are described here.

Adobe Illustrator was used for

- Image manipulation
- Graphics creation
- Colour enhancement



Its particular advantages were that it is the industry standard and works well with other graphics software. However, it is not easily compatible with

WORD and Windows PC users cannot easily send images to a non-graphics PC user. Further it was described as easy to use once trained but not easy for a beginner to pick up.

In terms of software development it was suggested that a warning dialogue box appearing on save advising of files size and offering compression would be useful.

Adobe Photoshop

We received a number of reports on the use of Adobe Photoshop versions 3 and 4 running under Windows and Windows NT and on Macs. The software was used in teaching and research and was generally found to be useful and easy to use.

Specifically Adobe Illustrator was used in:

- Image enhancement
- Colour changing
- Amending image brightness
- Changing contrast
- Filtering
- Scanning
- Image retouching
- Montaging
- Layering images
- Resizing

- Linking to WORD and Publisher documents

Particular advantages included:

- Ease of use
- Industry standard
- Variety of import/export formats
- Functionality for scanning
- Functionality for scanned image manipulation
- Versatile - scanning, image processing, web graphics
- Very accurate - more so than its rivals
- Plug-ins can be used for anything from special effects to scanning
- Cost - cheap with CHEST
- Integrates with other Adobe products (Illustrator/Page maker)
- Runs on a MAC
- Multipack licensing

Disadvantages were listed as:

- The manuals
- Harder to pick up than lesser programs like Paintshop Pro
- Sophisticated and slightly complex

Users would like to see the software developed to allow the importation of postscript files and a new, less cluttered, interface.

ASAP

We received one report on the use of ASAP in the social sciences. Version 1 running under Windows 3.1 was being used for teaching. ASAP was described as 'A brilliantly simple programme for preparing slides . . . more advanced programmes, like Freelance Graphics or PowerPoint, cannot compete.'

Particular advantages were listed as:

- Speed of use and response
- Instant conversion of material
- Pyramids, simple flow diagrams, produced with ease
- Intelligent sizing of fonts, clip art, etc
- One client (not server)

Problems with ASAP included:

- Lacks the capacity to produce targets and Venn diagrams
- No downwards flow diagram (only horizontal)

These could equally be regarded as areas for software development. The reviewer also commented that 'Software developers miss the point. Users want simple programmes with rapid response, low requirements of hardware, maximum reliability.'

AutoCAD

We received one brief questionnaire describing the use of AutoCAD, version 13 running under Windows NT in Archaeology.

The software was being used in the generation of 2D and 3D Drawings and in digitising. Used in both teaching and research, AutoCAD was described as being very useful but quite difficult to learn.

Corel XARA

Xara was used by one respondee who was running version 1.5 under Windows 95 for the creation of web pages and printed documentation.

Its main uses were for:

- Text layout
- Producing GIFs (some animated) for web
- Anti-aliasing
- Transparency
- Clipart

The positive features of Xara were listed as:

- Very fast-much more so than CorelDRAW or any other rivals
- Excellent on screen anti aliasing
- Accuracy

Two negative features were listed:

- Fewer features than DRAW
- Tech support rather pompous!

In terms of software development some of the CorelDRAW features Corel Xara lacks could be added.

Ghostview

A specialised package regarded as a useful tool by a project team member.

Ghostview is freeware available both for Windows and UNIX platforms. Its main uses are for

- viewing postscript files
- adding preview to ghostscript files
- converting postscript to eps

It is described as 'A free handy tool especially for printing problems'. It could be improved by extending eps conversion to include all types of postscript files.

Image Prep

This is a specialist graphics manipulation package which has proved to be very useful for converting and enhancing graphics images - particularly photographs. Used for manipulation of scanned photographic images for research software generation eg. Visualisation programs including travel simulators. These tools facilitate a car journey to be replicated on the PC for route choice research purpose.

We received a report from a user in Transport Studies carrying our research running version 4 of Image Prep. They regarded the software as being quite easy to use and very useful.

The most used features of the software were:

- Image editing
- Viewing images
- Image processing
- Image enhancement
- Image capture

The most valuable feature of the software was the Photo image enhancing facility. In some parts of the software it was difficult to know what all of the features and processes do however.

Imagetool

We received no reports of Imagetool being used by social scientists. If you are using it we would like to hear from you! The one completed questionnaire received was from a member of the project team in Computing Services who felt it would be of value to social scientists.

Imagetool is a free package with powerful image processing capabilities. Its main use is image analysis and it is quite easy to use. Developed by UTHCSA, as will all freeware, Imagetool has no guaranteed future development and no direct support.

LView Pro

Surprisingly few social scientists reported using LView in either their teaching or research. It may be that it was felt to be a utility rather than a visualisation tool and it is certainly in more widespread use that our survey results suggest.

LView is freeware. Its main use is to convert from one image file format to another. A large number of image formats are supported. It also has other features. Images may be increased or reduced in size. Image resolution may be altered and features such as colour and contrast may be adjusted. The software is particularly valuable in the preparation of images for importation into word-processing or desktop publishing packages. It is also of worth in the preparation of images for placing onto the World Wide Web.

Micrographx

We received one questionnaire concerned with Micrographx 4.1 running in a Windows environment on a 486 PC.

The software has a number of uses:

- As a translator to convert into different file formats
- To annotate graphic output from other software
- To draw illustrations

Micrographx was described as very easy to use and very useful - powerful software with a large array of functions. However, it was also described as often being slow and subject to crashing when working on large files with complex objects.

Paintshop Pro

Paintshop Pro was not used as widely as might have been expected. Just 4 questionnaires referred to it. It was used both in teaching and research. Paintshop Pro is regarded as easy to use and useful.

It was used for:

- Digital image editing down to pixel level
- Conversion between different image file formats
- Line drawing
- Image cleaning
- In WWW site creation

Its advantages were listed as:

- Relatively small size software, but still lots of useful image manipulation functions are included
- Cheap
- Robust
- Good Mailing List support
- Good Documentation (on line and paper)

Paintshop Pro's disadvantages include:

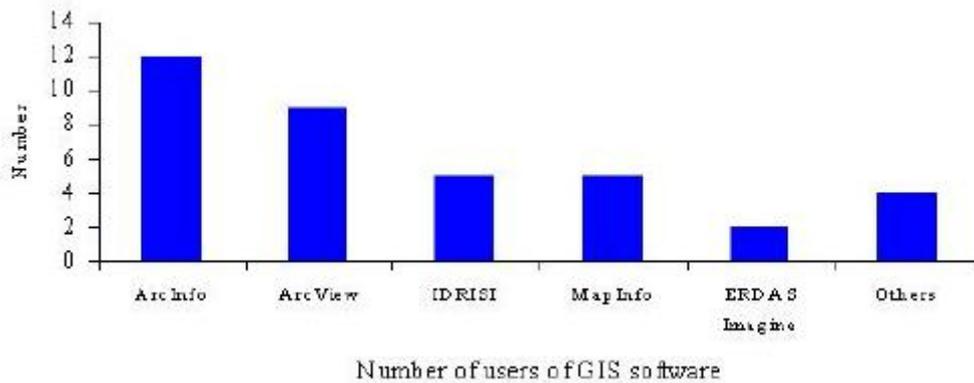
- You cannot view how an image will look when you print out the edited picture. The only way is to try test printing several times.

Suggested improvements included:

- WYSIWYG function is required
- Better re-sampling process is required (compared to Picture Publisher, reducing the size by re-sampling results in quite poor image quality)
- VRML support

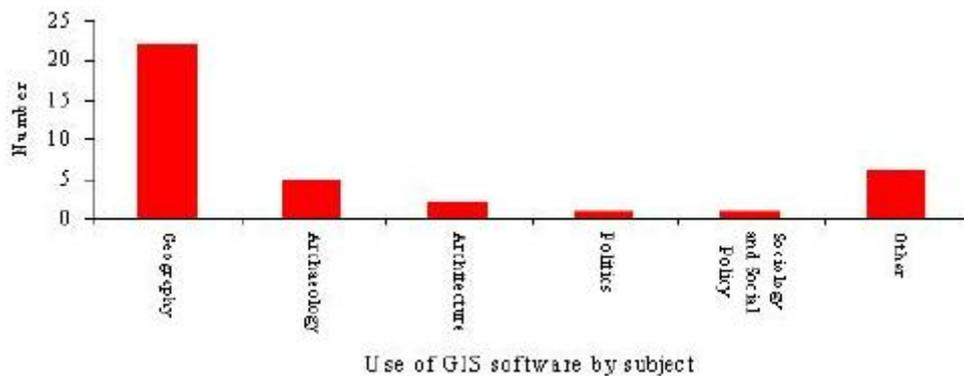
3.2.6 GIS software

ARCINFO and ARCVIEW were the most popular GIS packages in use based on questionnaire replies - 12 users reported using ARCINFO and a further 10 ARCVIEW. We received reports on the use of IDRISI and Map Info by four users each and two reports on the use of ERDAS IMAGINE. We received just one report on the use of the other GIS software listed below. We have also received comments from ERDAS (UK) Limited on the views of ERDAS IMAGINE posted.



GIS software was used most commonly in geography. Over half of our questionnaire replies in this software group came from geographers

working in geography departments. Five users in archaeology reported using GIS software in their work. In other areas of the social sciences the use of GIS technology was rare.



Responses were received for the following software.

ARCINFO

ARCINFO was the most popular GIS package in use in the social

sciences. It was either used in research or both teaching *and* research. Almost universally ARCINFO was regarded as a very useful tool. Equally, it was almost universally regarded as being difficult or very difficult to use.

Specific uses:

- To create coverages of study locations, and create hazard assessment models to determine the area's risk from soil erosion.
- M.A. GIS teaching
- M.Phil. GIS teaching
- Teaching GIS in Archaeology
- In BFC VRCIS, part of a JISC/JTAP funded project "the virtual field course"

Generic uses:

- Coverage creation
- Digitising modules
- Editing digitised topologies
- Calculation of areas
- Map overlays
- Vector/raster conversion
- Grid modelling
- Plotting

- Analysis
- Map generation
- Interactive map querying
- Database querying

Advantages:

- Main GIS used in industry
- Available under CHEST agreement
- Able to handle large volumes of data
- Extensive facilities available
- Multi-platform availability.
- Existence of digitised boundary data in ARCINFO format

Disadvantages:

- The considerable learning curve
- The poor windows interface - mostly command line driven - students expect a GUI.
- INFO database system is inflexible
- Limited, sometimes poor analysis capabilities
- Big and slow

Software developments:

- New GUI version
- Full windows version instead of DOS program
- From a visualisation point of view more tools for 3D modelling and visualisation and linked displays for exploratory analysis
- Better 'grid' analysis
- VRML support
- Internet map server technology

Other comments:

- 'It can do almost anything a GIS system should do.'
- 'Research use, with many one-off operations, usually requires use of the command line or programming interfaces, which require a high degree of familiarity with the system.'
- 'Once you know the commands it is a very easy package to use, with an excellent Menu driven help system.'

ARCVIEW

ARCVIEW was one of the most popular GIS packages in use. ARCVIEW tended to be used in research or both teaching and research. It was regarded as being either a 'useful' or 'very useful' tool. Views on user-friendliness varied. One respondent felt that the software was very easy to use. The general consensus was that ARCVIEW was fairly difficult to master however.

Specific uses of ARCVIEW included:

- In an introductory geography course.
- A course in GIS techniques
- Teaching GIS in Archaeology

- In a GIS course for post graduates
- ' I have used it for applications ranging from generating data which was used in predictive modelling of archaeological site location to determining the carrying capacity for large general stores in a city area.'

Generic uses:

- Tabular database creation
- Mapping attributes
- Map Display
- Map query
- Importing coverages
- Charting function
- Query building
- Spatial analysis
- 3D analysis
- Map generation for hard copy
- Customisation, extension

Advantages:

- Low cost software
- Visual appeal
- Quick display of data
- Easy to use and quick for the students to learn
- The ease with which ARC/INFO coverages can be manipulated
- Version 3 was reported to be 'much better than previous versions - it can do useful things like spatial analysis!'
- Much easier to use than ARC/INFO

Disadvantages:

- Limited functionality compared to a full GIS package
- Poor paper manual
- The package is large and slow to run over the network
- Error messages are uninformative or non-existent
- Reported problems in importing postscript files
- Not fully compatible with Microsoft's office for writing reports, etc

Software development:

- Better graphics
- Ability to accept more data formats
- More GIS operations e.g. a reliable buffer and clip for polygons and lines
- Better database functions
- More statistical abilities
- Develop along the lines of ARC/INFO in terms of functionality but on a PC with a Windows interface

Other Comments:

- 'NT has been a godsend as before ArcInfo and ArcView had to run under Unix to be useful.'
- 'I attended a two-day training course run by ESRI, then was on my own. I learnt enough of ArcView to create 3 data workshops for use in class and to teach students.'
- 'Though many features are fairly easy, I really have yet to see a GIS which is easy to use.'

CDV

CDV was written in TCL by Jason Dykes, as part of the JISC/NTI project. The software runs under Windows 95 or UNIX and was considered to be both very useful and very easy to use. One of the less widely used GIS packages used in both teaching and research.

CDV was used for:

- Highly interactive mapping
- Census data visualisation

Particular advantages of CDV were listed as:

- Multiple representations
- Object linking on screen
- Highly flexible

Disadvantages were listed as:

- Not 'production' quality
- Lacks things like a frame, scale, north point etc

ERDAS Imaging

A GIS package designed to plan for surface change such as urban development, transport planning and landscape planning.

We received two questionnaires discussing the use of ERDAS Imaging. Both users felt that the software was very useful but fairly difficult to use. One respondent wrote 'Very hard to start off with, but once you have conquered the initial problems it becomes a lot easier.' Specifically ERDAS was used in M.Phil. GIS teaching and Ph.D. research projects.

Applications used included:

- Image processing
- Image manipulation including orthorectification
- Image classification
- Image overlaying and merging
- Image display
- Visualisation of Satellite imagery
- Analysis of Imagery

The main disadvantage of ERDAS was listed as its cost although note the comments of the General Manager below. The software could be improved by upgrading the Windows NT release.

We have also received comments from the General Manager of Erdas (UK) Limited, Jonathan Shears, on the views posted. He states that

'ERDAS has been the primary Geographic Imaging software application for the higher education market since it was selected by CHEST in 1993 following an extensive survey by the IUSC Graphics Working Party which was funded by AGOCC. Over 50 universities now use ERDAS IMAGINE for both teaching and research, making it the most popular image processing application for the higher education market. ERDAS have pledged to include all new ERDAS owned software modules in this deal as they become available and recently this has included IMAGINE VirtualGIS - a powerful 3D visualisation tool which is pertinent to this survey, given its wide adoption.'

'Our users tend to be in earth science related applications - typically geography, geology and environmental science, however it is not limited to this . . . !'

In a separate e-mail to the visualisation-tools list Jon states

'It [ERDAS IMAGINE] links very well with ARC/INFO (also available through CHEST) on account of a unique technology exchange agreement between ERDAS and ESRI. Unlike Excel or SPSS, IMAGINE visualises pixel based datasets, rather than information from an underlying database, which is more the domain of GIS applications. As an inherently image based application, IMAGINE's visualisation tools therefore provide image panning, zooming, rotation, geographic linking of multiple windows, image overlay and transparency control for change detection studies.'

ER Mapper

ER Mapper was one of the less frequently used GIS packages. One respondent reported the use of the software in research for satellite image processing. ER Mapper was described as being 'fairly easy' to use and 'quite useful'.

Particular advantages were listed as:

- Ease of use
- Good human interface
- Ease of installation
- Low memory usage and good swap space handling.
- Simple handling of the dataset
- Large array of filtering algorithms
- Effectively scriptable

Disadvantages were cited as:

- Not very stable - liable to crash
- Print and export are not very efficient or reliable

ER Mapper would be improved through the introduction of improved 3D and export capabilities.

GIMMS

A computer cartographic package with the capability in addition to create a range of business graphics. Once widely used. Now it is being superseded by newer software and this is reflected in that only one questionnaire was received making reference to the software. Initially GIMMS would only run on mainframe computers. However, it has now been available for PCs for some time, first running under DOS and later under Windows - but effectively in a DOS window.

The software is not as easy to use or to learn as full windows mapping packages such as ARCVIEW. The command language is complex and it takes some time to become familiar with it. There are some specific problems. On fast PCs a plug-in dongle restricting use of the software under licence may not be recognised. Colour output is fairly poor and the range of fill patterns are very limited. Although a range of text fonts are available text output can be of poor quality. Postscript files are large. Software bugs were also reported

GIMMS was mainly used for creating maps, creating graphics and for the importing and exporting of boundary files.

On the positive side, GIMMS was regarded as largely providing good results with the capability to produce maps rapidly. Once the command language has been learnt it can be flexible. Users are reluctant to give the package up having spent so much time mastering it. In its time it was before its time. Software design has moved on.

IDRISI

An inexpensive raster GIS for introducing GIS concepts to students. Based on our survey results IDRISI was in the 'second division' of GIS packages based on usage. IDRISI was not used as extensively as software such as ARC/INFO but it was in more common use than a number of other software packages.

IDRISI was used both in teaching - in GIS and Remote Sensing courses - and in research and consultancy. IDRISI was described as 'Ideal for teaching-conceptually simple'. It was considered to be fairly useful and reasonably easy to use.

The main advantages of IDRISI were listed as:

- Easy to use
- Inexpensive - exceptionally wide functionality for such low-cost software.
- Robust
- Good mailing list support
- Good documentation (on line and on paper)
- Good geographical analysis features
- Minimal hard disk requirements
- Hard for students to make errors which are not easily recovered
- Standard Windows menu system means shallow learning curve.
- Actual use is very close to conceptual idea of GIS
- Lots of 3rd party modules.

Features commonly used included:

- Image display
- Overlay
- Plotting
- Buffering

IDRISI could be improved in a number of ways:

- VRML support

- Better printing capability
- NTF format filter
- Algorithms such as triangulation
- Better orthographic display
- NT 4 version at a more competitive price

MapInfo

MapInfo is used fairly extensively for both teaching and research. Whilst most users found the software to be useful a number reported that the software was difficult to use and the documentation poor.

Specifically cited uses included:

- To create political thematic maps of Russia showing, for example, the distribution of population, average wage, etc. in 89 regions. This is for a book but MapInfo has also been used for some presentation, papers and an article.
- Introduction to commercial mapping 1st and 2nd year students.
- Introductory GIS - 2nd year.
- 3rd Year projects and Dissertation work
- Used to teach modules in: Geodemographics and GIS for Business

Generic uses for MapInfo were listed as:

- Thematic maps
- Vector mapping
- Raster Mapping
- Buffering
- Creation of new points and regions
- Data integration
- Structured Query Language selection of data
- Layouts for professional output
- Visualisation of previously hidden patterns
- Graphing

Advantages:

- Will link to data in software such as Excel, Access and SPSS
- Excellent output
- Ability to embed images to Word Document

Disadvantages:

- Very difficult to learn. One respondent wrote 'Learning the Software was a disaster.'
- One Windows 95 version was reported to have serious bugs.
- Very poor documentation
- Inability to complete certain complex tasks
- High system requirements and greedy for disk space
- Software and data are very expensive
- Inconsistent treatment of objects
- Poor handling of free text data

- Limited spatial analysis tools
- Absence of link-node topology
- Limited implementation of georelational data model.
- Price

Developments:

- It would be far more useful if it were easier to use.
- Embedding of robust statistical techniques for analysis of temporo-spatial clustering.
- Better raster handling is needed.
- Resolve the problems mentioned above.

MapMaker

We received one brief report on the use of MapMaker in Geography running on Windows NT 3.5

The software was used in both teaching and research for mapping data. Its main advantage was that it could produce accurate maps. However, MapMaker was not as user friendly as it could be. Students had difficulty navigating through menus which were not always logically ordered. There was no database direct linkage internal to the package and output quality was not always satisfactory.

3.2.7 WWW software

The survey highlighted as an area of interest World Wide Web software. We were curious to learn of the use to which the web was being put in the social sciences to assist in visualisation. We expected some general comments on the utility of browsers such as Netscape and Explorer. We further expected mention of the use of static images in the form of gifs (and animated gifs) and JPGs, video technology such as AVI and MPEG, and other technologies such as Java, VMRL etc.

In fact, we received one questionnaire reply making brief mention of the use of Netscape. Amongst most social scientists our findings indicate that the WWW is not important in terms of data visualisation.

4. Conclusion

For those interested in promoting the use of visualisation techniques in the social sciences the survey results are fairly depressing, although they may take solace in that there is plenty of work to be done. In many social science subjects visualisation tools are simply not being used. Outside geography departments those tools that are being used are employed in the creation of simple computer graphics such as scattergrams, histograms and bar charts. In many instances the most frequently used packages such as Excel and SPSS are being used to store and manipulate data, not to visualise it through the use of computer graphics.

This survey attempted to raise an interest in visualisation in the social sciences. Every social science department in the United Kingdom received at least one letter describing the project. Three separate messages were sent to a large number of e-mail discussion groups. A dedicated set of web pages based around the project was constructed and a discussion group was started.

Software manufacturers were contacted. Some colleagues advised us that they received three letters describing the project and requesting assistance – two from their Head of Department and a third sent directly to them – and many, many, many copies of our e-mails to discussion groups. It may be that there are social scientists using best practice in advanced visualisation techniques but, overall, they did not reply to this survey.

The project's web pages will continue beyond the completion of this survey, as will visualisation-tools. Any further comments from software manufacturers will be posted to the discussion group. A copy of the full survey, in Microsoft Access format, can be ordered from the web service.